

DATA SET 202

TRANSMITTER-RECEIVER EQUIPMENT

FOR FM SERIAL VOICEBAND TRANSMISSION

DATA SYSTEMS

1. GENERAL

Connections to the customer's equipment are via a cable provided by him which plugs directly into a 25-pin KS-19357, List 2 connector on the rear of the set. Signals to the customer over this cable are designated Received Data (RD), Clear to Send (CS), Carrier On-Off (CO), and Interlock (IT). Signals from the customer are termed Send Data (SD) and Request to Send (RS). These inputs and outputs to the set are in the form of direct voltages which conform to Electronic Industries Association (EIA) Standards. These standards define space or on as +3 to +50 volts dc mark or off as -3 to -50 volts dc. Exceptions to these standards are off for interlock which is ground, contact closures in the customer's equipment which indicate ready for automatic answer and provide remote release, and a contact closure in the data set for ringindicator. Frame ground and signaling ground leads are also provided as a common reference.

The transmitting portion of the set is a modulator which converts a negative voltage on the SD lead to a 1200-cps tone for mark and a positive voltage to a 2200-cps tone for space. A positive voltage on the RS lead turns the modulator on (1200 cps in the absence of any voltage on the S/D lead) and causes a positive voltage to be returned to the customer 200 msec later on the CS lead. The receiver portion is a demodulator which converts these tones back to plus or minus 8 volts dc on the RD lead. Receipt of either signal causes the CO lead to go positive (on) after a delay of 50 msec and remain on for 15 msec after the signal is removed. A clamp on the receiver output is removed when this lead is positive. This clamp or squelch is also applied for 80 msec after turn off of the RS signal to block reception of echo return.

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1. GENERAL

Scope

1.01 This specification, together with the supplementary information listed herein, covers the equipment design requirements for the framework, equipment, and circuits to be used in the manufacture and installation of data set equipment for medium speed FM serial data transmission. This equipment is primarily intended for DATA-PHONE service.

Description

1.02 This equipment is intended to be used in 2-way FM data transmission systems over standard switched voice telephone facilities or private lines. On 2-wire facilities, the operation is called half duplex in that the set can transmit and receive but not simultaneously. The receiver portion monitors the transmitted data for the customer. Full duplex operation is possible on 4-wire facilities; the set can transmit and receive simultaneously. These sets are designed for use at bit speeds up to 1200 bits per second on switched connections and up to 1600 bits per second on especially equalized fixed connections. The use of asynchronous operation permits complete flexibility of the bit speed.

1.03 Connections to the customer's equipment are via a cable provided by him which plugs directly into a 25-pin KS-19087, List 2 connector on the rear of the set. Signals to the customer over this cable are designated Received Data (RD), Clear to Send (CS), Carrier On-Off (CO), and Interlock (IT). Signals from the customer are termed Send Data (SD) and Request to Send (RS). These inputs and outputs to the set are in the form of direct voltages which conform to Electronic Industries Association (EIA) Standards. These standards define space or on as +3 to +50 volts dc and mark or off as -3 to -50 volts dc. Exceptions to these standards are off for interlock which is ground, contact closures in the customer's equipment which indicate ready for automatic answer and provide remote release, and a contact closure in the data set for ring indicator. Frame ground and signaling ground leads are also provided as a common reference.

1.04 A 6-button telephone set associated with the data set is necessary for operation over the switched network. The telephone is used to set up the circuit,

provide voice service, and test the operating mode. The buttons are designated as DATA, TALK, TEST, and ANSWER. The third pickup, which is picked up first, is used for voice or data transmission. When data is being transmitted, the data set contains an integrated telephone set. It is intended to be used only as a switched telephone network. Data set may or may not be connected to the telephone set, depending on whether it is to be used for the switched data or for voice service.

1.05 The transmitting portion of the set is a modulator which converts a positive voltage on the RS lead to a mark or space tone for mark and a positive voltage to a space tone for space. A positive voltage on the RS lead turns the modulator on (10 cps in the absence of any voltage on the RD lead) and causes a positive voltage to be returned to the customer 200 msec later on the CS lead. The receiver portion is a demodulator which converts these tones back to plus or minus 5 volts dc on the RD lead. Receipt of either signal causes the CS lead to go positive (on) after a delay of 90 msec and remain on for 15 msec after the signal is removed. A clamp on the receiver output is removed when this lead is positive. This clamp or squelch is also applied for 80 msec after turn off of the RS signal to block reception of echo return.

1.06 An automatic answering feature is standard equipment. This may be connected or not or selected with a push-button by installer option. In response to ringing, this equipment sends a 1- to 2-second-long mark frequency tone, 4 to 5 seconds after trip of ringing, and then places the set in the data mode. This feature is under control of the customer equipment via the ready and remote control leads. A contact closure must be maintained between the remote release lead and remote control lead by the customer except for momentary interruption to terminate a call. A contact closure on each ring cycle is also provided for the customer on ring indicator leads.

1.07 The TEST button operates a test relay which locks up under control of a tone from a remote test center. This relay connects internal circuitry which permits the test center to measure mark and space frequencies, the receiver slicing point,

transmitter output level, receiver sensitivity, and to verify proper functioning of the input and output connections to the customer. With the receiver replaced in the cradle, depressing the TEST button will release the test relay in spite of a tone on the line.

1.08 Do power is supplied from a built-in supply which plugs into 115-volt AC cycle supply. A power cord equipped with a 3-prong plug having a U-type ground pin is supplied with the set. Approximately 7 watts are required.

1.09 This equipment is designed to operate over a temperature range of 32 F to 120 F and a relative humidity of 10 to 90 per cent.

Data Set 202A (See Fig. 1.)

1.10 Since the telephone and data equipment are mounted as single unit, the set is called an integrated data set. It is equipped with a D19A-61 cord for connections to the telephone lines. A 2-piece cycloc housing encloses the equipment which is mounted on a dark grey, moulded Fiberglas baseplate. The front housing contains the handset, keys, ringer, terminal strip, network, and dial and is a high-gloss light grey. A dull medium grey, rear housing encloses the data equipment. This set is equipped for use on 2-wire lines only.

Data Set 202B (See Fig. 2.)

1.11 This set contains the same data equipment as the data set 202A, except that the telephone and keys are not included; in addition, it contains facilities for connection to a 4-wire line. It may be used on 2- or 4-wire switched voice line by connecting a separate telephone set. For 2-wire switched lines, a 569NB telephone set is required; on 4-wire switched lines, a 568HB telephone set plus a 4-wire line circuit is necessary. Line and telephone connections are made through a D24B cord. When no telephone is required, the set is furnished with a test key mounted in front at the lower right corner. The front and rear housings are separate pieces and in the same colors as in data set 202A but are fastened together as one unit.

1.12 When a data set 202 replaces a data set modulator 3A, an adapter cord is required to accommodate the business machine cord to the jack on the data set.

2. SUPPLEMENTARY INFORMATION

ED-1D050-01 - General Equipment Requirements for Data Sets

X-17980 - Manufacturing Test Equipment and Specification for Data Set 202A and 202B Transmitter-Receiver

SD-1D003-01 - Data Set 202A Framework Assembly

SD-1D019-01 - Data Set 202B Framework Assembly

SD-1D020-01 - Data Set 202A and 202B Control Printed Wiring Board Assembly

SD-1D007-01 - Power Supply Assembly

SD-1D065-01 - Test Switch Assembly

3. DRAWINGS

Circuitry

SD-1D003-01 - Data Set 202A

SD-1D019-01 - Data Set 202B

SD-1D020-01 - Line and Test Station

Equipment

ED-1D004-() - Data Set 202A and 202B Modulator Printed Wiring Board Assembly

ED-1D005-() - Data Set 202A and 202B Demodulator Printed Wiring Board Assembly

ED-1D006-() - Data Set 202A and 202B Control Printed Wiring Board Assembly

ED-1D007-() - Power Supply Assembly

ED-1D065-() - Test Switch Assembly

4. EQUIPMENT

J1D202A (AT&TCo Std) - Integrated Telephone, Keys and Transmitter-Receiver Equipment for FM Serial Voiceband Transmission

List 1 - Framework, assembly, wiring, and equipment per SD-1D003-01, Fig. 1, 2, 3, & 4.

J1D202B (AT&TCo Std) - Separate Transmitter-Receiver Equipment for FM Serial Voiceband Transmission

List 1 - Framework assembly, wiring, equipment, and rear cover (front cover not included) per SD-1D019-01, Fig. 1, 2, 3, & 4.

List 2 - Front Cover

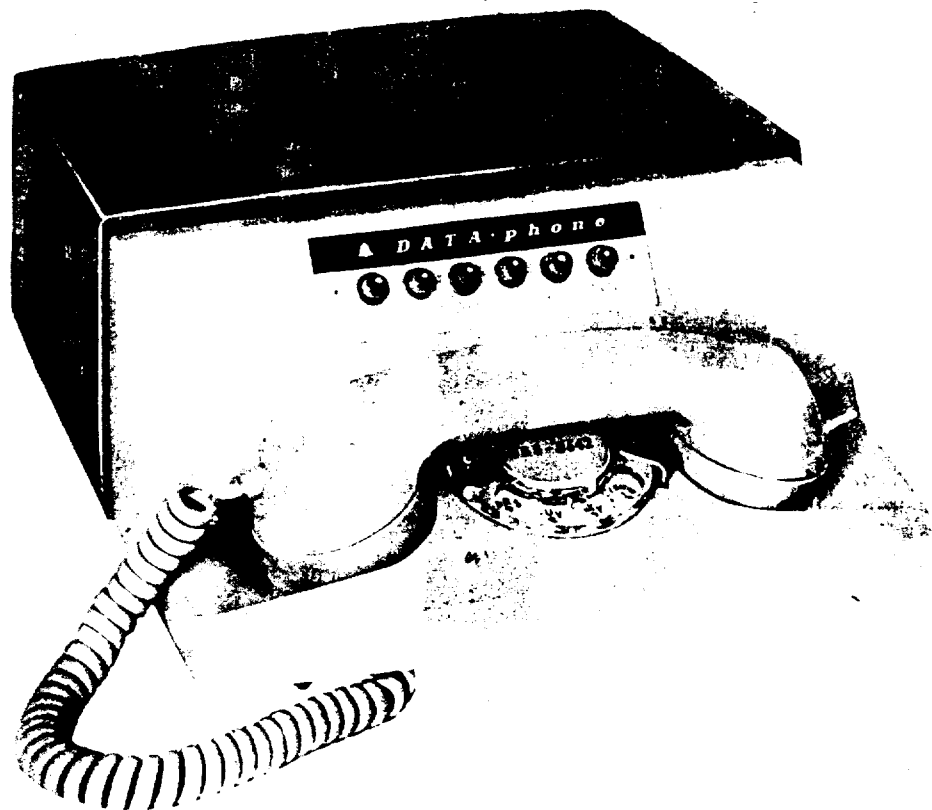


Fig. 1 - Data Set 202A

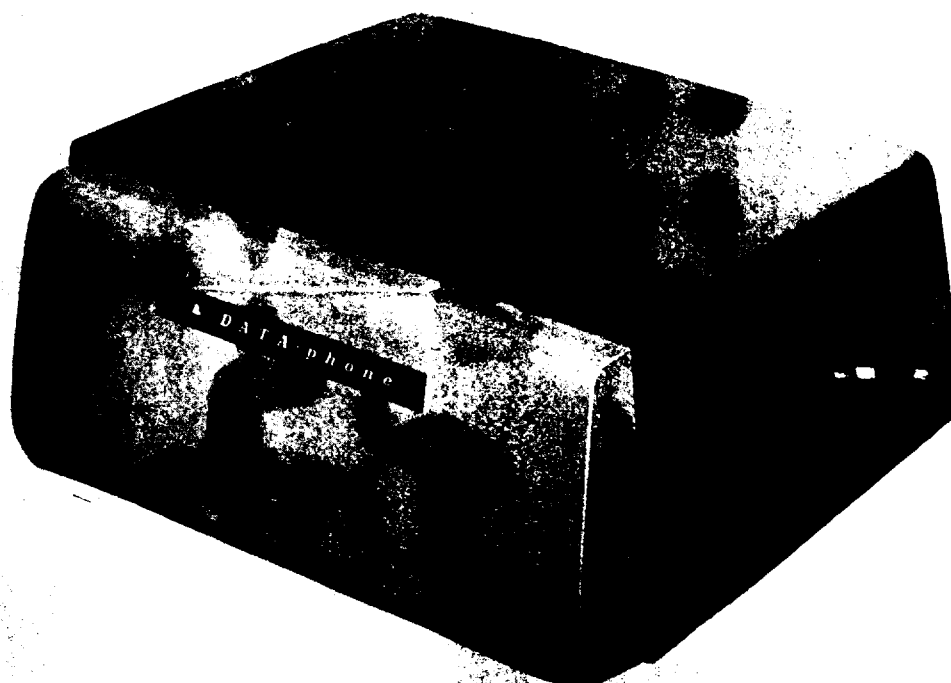


Fig. 2 - Data Set 202B

List 3 - Front cover equipped with test button assembly. Test switch assembly per ED-1D065-() connected as shown on SD-1D019-01, Fig. 8

5. GENERAL NOTES

5.01 Telephone set 569NB is required in addition to lists 1 and 2 for 2-wire switched network applications. See Fig. 5, SD-1D019-01.

5.02 If telephone lines picked up by the spare keys are associated with either 1A or 1A1 key systems for pickup and holding, a 229B KTU auxiliary relay unit must be added to the KTU equipment. See Fig. 6, SD-1D019-01.

5.03 Telephone set 568HB is required in addition to lists 1 and 2 for 4-wire

switched network applications. It is also necessary to provide a 243 KTU 4-wire subscriber line circuit and three 229B KTU auxiliary relays. The spare pickup buttons may be 2-wire or 4-wire or mixed, and arranged for holding. See Fig. 7, SD-1D019-01. (References: SD-69414-01 and SD-69425-012)

5.04 Lists 1 and 3 are intended for 2- or 4-wire private line applications where no telephone is required. A test button mounted on the front housing of the data set provides the self-testing feature. See SD-1D019-01, Fig. 8.

5.05 Line and test switch per SD-1D020-01 shall be installed on 4-wire private line applications to permit back-to-back testing by the customer and to provide uninterrupted termination to multipoint private lines when the data set is disconnected for maintenance or testing.

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Dept 5315

DESIGN PARAMETERS OF ON-LINE MEASURING EQUIPMENT OUTPUT

1. PURPOSE. The purpose of this paper is to outline the design parameters for developing a direct communication link between coordinate measuring equipment and a central computer on a real-time basis.

2. SCOPE. Transmission between the computer and the remote station is to be via two twisted pair of standard 18 or 20 gauge telephone quality lines. Adequate steps have been taken to insure minimum interference from outside sources. One pair of transmission lines, commencing at the central computer site, is to be connected to a page printer. The contractor, however, is to have no responsibility for the printer except for consideration of placement within the operator's immediate control.

The second pair of lines to the computer is to be connected to the measuring equipment digitizing system through a pair of Western Electric Company Data Phone subsets, model 202B lists 1, 3, A, and B. One Data Phone will be located at the computer room, and the contractor is to have no responsibility for this unit. The second Data Phone is to be mounted in the digitizing system, and the contractor is responsible for providing the necessary interface connection. In all cases, the customer will be responsible for providing the Data Phones and Printers. For the purpose of this paper, the measuring equipment and digitizers are understood to consist of a measuring engine, pulse generators, pulse decoding system, digital accumulators, buffer storage as required, and circuitry for generating special characters as later explained. There is to be no data connection between the printer and digitizer except through the computer link.

3. TRANSMISSION INTERFACE. The Data Phone interface is to meet the following requirements:

- a. Electronic Industry Associates (EIA) specifications to which the Data Phone was built. It is currently EIA-RS 232, but should be checked prior to final design for any changes.
- b. Data Phone to operate in the half duplex mode.
- c. Transmission is asynchronous with the rate of transmission to be fixed at 1200 bits per second $\pm 1\%$ tolerance, and is binary serial.
- d. A voltage within -8 to -20 represents off or marking (1), a voltage within +8 to +20 represents on or spacing (0).
- e. In addition to the information bits to be transmitted, two pulsing bits must be transmitted for each character. A start pulse is a space or (0) and is the same duration of the other bits. A stop pulse is a mark or (1) and is a minimum of 1.5 bits in length but may be longer.

4. CODE REQUIREMENTS. The code to be transmitted will meet the following requirements:

- a. Code to be used will be Field Data Code, consisting of a 6-bit character plus one parity bit. Parity is to be odd.
- b. The 2^0 or least significant information bit is the first bit to be transmitted from each character.
- c. Parity is to be the 2^6 bit and is the last information bit of each character to be transmitted.

5. MESSAGE GENERATED. The message to be generated by the measuring equipment system shall consist of: (See appendix A for output sequence.)

- a. Digital coordinate values for each axis of the system. This shall normally consist of six decades plus sign per axis.
- b. A start of message character (SOM).
- c. An end of transmission character (EOT). (This bit configuration would normally be a parity error).
- d. A message parity count (MPC). This is the sum of bits of all characters transmitted (including SOM and EOT), and is non carry add. Lateral parity is odd. Longitudinal parity is even. The parity bit is to be the sum of the longitudinal parity bits.
- e. Four special instruction characters, each generated by four operator controlled push on, push off back lit switches, two dummy bits (mark or 1), and a parity bit generated by the equipment based on the condition of the four switches. The fixed dummy bits will occupy the 2^4 and 2^5 bit positions.
- f. A special readout character generated by five momentary contact push button switches and two fixed dummy bits occupying the 2^5 and 2^6 bit positions. The dummy bits are to be spaces or 0's. It is understood that the parity (2^6) is to be fixed at 0 so that if two of the five switches are pressed at the same time, a parity error will be detected. The five switches are to be understood as readout switches and will also control the request to send, SOM and text as later described.
- g. Three rotary switches are to be provided for machine identification purposes. These switches are to have the capability to create 0 to 9 and are to be placed in the equipment so that only the maintenance engineers will have the capability to change them.

h. A minimum of 12, twelve position rotary switches. These switches are to have the capability of producing 0 to 9, minus (-), and EOT.

5. SPECIAL CIRCUITS. There is to be no character by character acknowledge signal received by the digitizer output circuit. However, there is to be a message acknowledge or error signal received on the basis of the total message transmitted. The reply will consist of SOM, A or E, EOT, and MEC. In addition, a timer is to be incorporated in the equipment to trigger an alarm if the reply is not received in a predetermined time to be specified by the customer. The output is to be held in the digitizer buffer until an acknowledge is received or the timer alarm is triggered. If an error signal is received due to a bad transmission, the timer is to be reset and another attempt at transmission is to be made. After a set number of attempts of retransmission (under computer control), an acknowledge or error signal will not be returned and the timer will time out. If a readout is initiated but never reaches the computer, the timer will also time out, warning the operator that the transmission is not taking place. Since the Tama Phones are to be operated in the half duplex mode, the return acknowledge or error must pass over the same lines and will not be transmitted until the digitizer transmission is completed and the line phase relationship is reversed.

In addition, an indicator light is to be placed on the control panel in close proximity to the readout switches. On depressing any one of the five readout switches the light is to turn on and remain on for approximately one second or until an acknowledge signal is received, whichever is longer. This will indicate to the operator that a readout has been initiated within the digitizer.

A numerical display of the coordinate system should be placed on the measuring engine within the operator's field of view. A reset button for each axis shall be placed on the control. It is also desirable but not mandatory that a master reset button be provided and a manual set feature for each decade of the counter to give the operator the ability to set the counter value to a predetermined value other than zero.

7. SEQUENCE OF OPERATIONS. Having properly set up the measuring equipment as instructed, the operator will proceed to take measurements and thus transmit data. Prior to actuating the readout mechanism he will set up the necessary computation instructions on the 16 push on, push off switches comprising the four instruction characters. Then, on aligning the reference mark with the image he will depress one of the five readout switches comprising the readout character.

On actuating one of the five readout switches, the digitizing system will set the timer, energize the readout indicator light, and apply the request to send signal to the Data Phone. On receipt of the clear to send, the bit by bit message will be fed to the Data Phone as indicated in Appendix A.

After sending the message, the digitizing system will await the acknowledge or error signal. If an acknowledge signal is received, the buffer storage will be released and ready to accept the next readout. If an error signal is received, the above procedure is repeated (including resetting the timer and readout light) sending the identical message. After a set number of tries under computer control, neither an acknowledge or error signal will be sent to the digitizing system from the computer and the timer will time out, energizing an audible alarm indicating that transmission had not been successful. Also if the Data Phone lines fail to set up, the timer is to time out giving an alarm. When an alarm occurs, the operator is to reset the alarm circuits by controls to be provided and attempt retransmitting or repair maintenance.

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APPENDIX A

Typical Readout Sequence

Output Sequence	2 ⁶	2 ⁵	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰
1. SOM	1	0	1	1	0	1	1
2. Readout Character	0	0	X	X	X	X	X
3. Instruction Character	P	1	1	X	X	X	X
4. Instruction Character	P	1	1	X	X	X	X
5. Instruction Character	P	1	1	X	X	X	X
6. Instruction Character	P	1	1	X	X	X	X
7. Sign plus	1	0	0	0	1	0	1
minus	1	1	0	0	0	0	1
8. X value 10 ⁵	0 to 9						
9. X value 10 ⁴							
10. X value 10 ³							
11. X value 10 ²							
12. X value 10 ¹							
13. X value 10 ⁰							
14. Sign plus	1	0	0	0	1	0	1
minus	1	1	0	0	0	0	1
15. Y values 10 ⁵	0 to 9						
16. Y values 10 ⁴							
17. Y values 10 ³							
18. Y values 10 ²							
19. Y values 10 ¹							
20. Y values 10 ⁰							
21. (Machine identifiers)	0 to 9						
22. (Machine identifiers)							
23. (Machine identifiers)							
24. 12 Position Rotaries	0-9, -, EOT						
25. 12 Position Rotaries							
26. 12 Position Rotaries							
27. 12 Position Rotaries							
28. 12 Position Rotaries							
29. 12 Position Rotaries							
30. 12 Position Rotaries							
31. 12 Position Rotaries							
32. 12 Position Rotaries							
33. 12 Position Rotaries							
34. 12 Position Rotaries							
35. 12 Position Rotaries							
36. MPC	SEE TEXT						

X = bits controlled by operator switches

P = Parity bit generated by equipment as required on the basis of the condition of the X positions.

	2 ⁶	2 ⁵	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰
0 =	1	1	1	0	0	0	0
1 =	0	1	1	0	0	0	1
2 =	0	1	1	0	0	1	0
3 =	1	1	1	0	0	1	1
4 =	0	1	1	0	1	0	0
5 =	1	1	1	0	1	0	1
6 =	1	1	1	0	1	1	0
7 =	0	1	1	0	1	1	1
8 =	0	1	1	1	0	0	0
9 =	1	1	1	1	0	0	1
-	1	1	0	0	0	0	1
EOT	1	0	1	0	1	0	1
Error	1	0	0	1	0	1	0
Acknowledge	1	0	0	0	1	1	0

EOT must be placed on one of the 12 position rotary switches and will be immediately followed by the MPC.